from legacy systems may be organized in tables that do not fit an object-oriented view of the data.

[0164]   As with most relational database systems, a significant part of the power of the system is not simply the data stored within it, but is the ability to relate these data elements together. A large number of the most important data relationships are built directly into the Data Model. For example, a road furniture Entity is naturally related to the sections of road on which that road furniture lies. Because so many elements in the system are related to the roadway, it is relatively easy to perform powerful queries that use the roadway to relate different types of data. For example, the query "count the number of accidents that occurred on roads with the speed limit greater than 60 mph" can be generated because accidents are related to road sections and road sections have a speed limit attribute; the road sections (i.e., Road Section ID and Division Section ID values) are the join field relating these two types of data.

[0165]   Although the relationships between the Entity class types define many of the key relationships that will be used to query the data, these relationships are based on general relationships between types of defined Entities. Some relationships are based on the particular Entities involved and, therefore, are neither listed in this table nor part of a relationship that can be derived from the data model. For example, a table Entity containing road maintenance expenditure data may include a column that contains the standard code of the county in which the expenditure was made. The presence of this column establishes a relationship between the rows in this table and

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the county Entities. These Entity-specific relationships are represented as "Relates", which have the following properties:

[0166] **Relate ID**. Each Relate is identified by a unique numeric ID, the Relate ID.

[0167] **Relate Entities.** Each Relate defines a relationship between two Entity

5 classes, Entity Class 1 and Entity Class 2. This property defines those Entity classes.

[0168] **Name.** The Name is used to refer to the relationship from Entity Class 1 to Entity Class 2. This property is used to help specify ad hoc queries by helping the user select the appropriate relationship between Entities.

10 **[0169]** **Relate Type.** The Relate Type specifies the cardinality of a Relate. The cardinality is of the form {one | one (optional) | many | many (optional)} to {one | one (optional) | many | many (optional)}. This property is required in order to tune certain queries. For example, if the user wants to count the number of Entities selected, but the query includes a one-to-many Relate, the

15 query must group by the Entity ID in order to remove multiple records with the same Entity ID before counting.

[0170] **Relationship.** The Relationship property is a string that specifies the "where" clause that should be part of an SQL statement that uses this Relate.

[0171] **Relate Attributes.** The Relate Attributes lists the Attributes that are

20 required to support the "where" clause specified in the Relationship property. The ad hoc query tool uses this property to ensure that all of the tables required

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to support the Relationship "where" clause are correctly joined as part of the resulting SQL statement.

The Query Model

5   **[0172]**   A feature of system and method is the ability to query the database. For example, each report is based on the results of a query, and the data related to the features on a map are obtained by executing a query. The data model is complicated, making generation of an SQL statement for a query difficult. This difficulty is compounded because dynamic segmentation is used to relate many Entities and

10   attributes to the road network, and queries that resolve dynamic segmentation data are always complicated.

[0173]   Despite these difficulties, the data model includes a number of features that help simplify generation of queries. First, the Entity-Attribute representation of the data allows most queries to be formed from a very limited list of relationships, as

15   depicted in Figure 15.

[0174]   Referring now to Figure 15, most queries involve a primary Entity class 1501 that determines the type of results that are allowed. For example, for a query that generates a summary report of road-miles or lane-miles, the primary Entity class 1501 is either Road Sections or Division Sections. For a query that generates the

20   sections of county roads on which bridges lie, the primary Entity class is also either Road Sections or Division Sections. For a query that counts the number of bridges on each highway, the primary Entity class is the Bridge Entity.